**Practice Questions for Evolution Unit**

A large population of laboratory animals has been allowed to breed randomly for a number of generations. After several generations, 25% of the animals display a recessive trait (*aa*), the same percentage as at the beginning of the breeding program. The rest of the animals show the dominant phenotype, with heterozygotes indistinguishable from the homozygous dominants.

1. What is the most reasonable conclusion that can be drawn from the fact that the frequency of the recessive trait (*aa*) has not changed over time?

A) The population is undergoing genetic drift.

B) The two phenotypes are about equally adaptive under laboratory conditions.

C) The genotype *AA* is lethal.

D) There has been a high rate of mutation of allele *A* to allele *a*.

E) There has been sexual selection favoring allele *a*.

2. What is the estimated frequency of allele *A* in the gene pool?

A) 0.25

B) 0.50

C) 0.75

D) 1.00

3. What proportion of the population is probably heterozygous (*Aa*) for this trait?

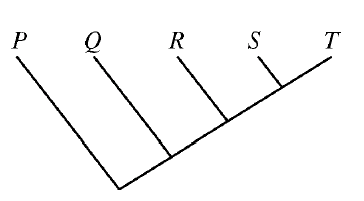
A) 0.05

B) 0.25

C) 0.50

D) 0.75

4. Which of the following conclusions is best supported by the cladogram on the right?

A) Species P and Q are equally related to species T.

B) Species P and T do not share a common ancestor.

C) Species S evolved from species R.

D) Species S is more closely related to species T than to species R.

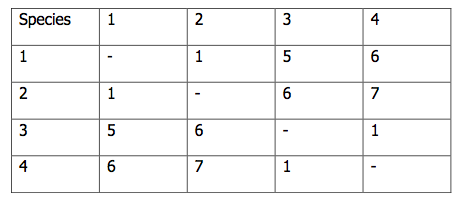
5. Cladograms constructed from evidence from molecular data are based on similarities in

A) mutations to homologous genes

B) the pattern of embryological development

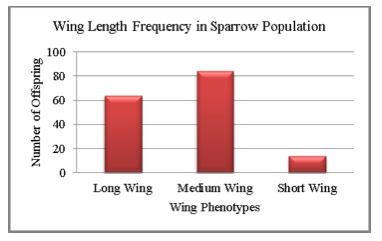
C) biochemical pathways

D) morphology

Four new species of plants were discovered in Greenland ice core samples. The nucleotide (base) sequences of rRNA subunits were determined for the new species. The table below shows the number of nucleotide differences between the species.

6. Create a cladogram for the data provided.

A group of biologists is studying the effect of extreme weather conditions on a population of sparrows. The population of sparrows resides in the Midwest, which has experienced several thousand severe storms over the past decade. The biologists hypothesize that the increase in storm frequency and severity has an effect on the frequency of long and short-winged birds, since medium-sized wings allow the birds to survive these storms better. The biologists collect phenotype frequency data about the wing length trait in the sparrow population, shown below.



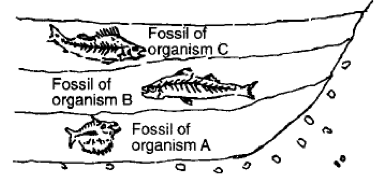
7. Which of the statements below would be supported by the researchers’ data?

A) Sparrows with short wings will be directionally selected for in environments where severe storms are common.

B) Stabilizing selection occurs in environments where severe storms are common, selecting for sparrows with medium-sized wings.

C) Disruptive selection selects for both sparrows with long and medium-sized wings in environments where severe storms are common.

D) The frequency and severity of storms has no effect on the sparrow wing phenotype frequency.

8. The diagram on the right represents undisturbed rock strata in a given region. A representative fossil of an organism is illustrated in each layer. Which statement best describes a relationship between these representative organisms?

a. Organism A was probably more structurally advanced than organism B and organism C

b. Organism C probably gave rise to organism A and organism B

c. All of these organisms probably evolved at the same time

d. Organism A was probably more primitive than organism B and organism C

9. If two modern organisms are distantly related in an evolutionary sense, then one should expect that

A) they should share fewer homologous structures than two more closely related organisms.

B) their chromosomes should be very similar.

C) they shared a common ancestor relatively recently.

D) they should be members of the same genus.

10. A population of squirrels is preyed on by small hawks. The smaller squirrels can escape into burrows. The larger squirrels can fight off the hawks. After several generations, the squirrels in the area tend to be very small or very large. What process is responsible for this outcome, and what would you predict would be its effect on allele frequencies?

A) Directional selection; the allele for small squirrel size is not favored over the allele for large squirrel size

B) Disruptive selection; the allele for large squirrel size is favored over the allele for small squirrel size

C) Stabilizing selection; the alleles for large and small squirrel size are found in equal frequency in the

population

D) Disruptive selection; the alleles for large and small squirrel size are favored equally in the population

Trout in stream A and trout in stream B look similar, but not quite identical. Scientists were unsure if they were two populations of one fish species, or two separate species. To figure this out, they studied the life cycle, habitat, and reproduction of the trout. In a year with a typical amount of rainfall, the trout stay within their own stream and mate with individuals that live nearby. However, in years that include excessive rainfall and flooding, the fish are washed downstream to a larger river, and must swim back up into either stream A or stream B. They choose which stream to swim up randomly, often ending up in a different location than where they themselves were born. When a trout that originated from stream A does breed with a trout from stream B, their offspring are healthy and show no decrease in fertility. Scientists think that flooding in this watershed is happening more and more frequently, due to global climate change.

11. Given this information, predict what is the most likely result for trout A and trout B.

a. they will become reproductive isolated from each other

b. they will become more similar in their gene pools

c. they will go through random changes due to genetic drift

d. they will adapt to different conditions and look more and more different

12. Beetle pollinators of a particular plant are attracted to its flowers' bright orange color. The beetles not only pollinate the flowers, but they mate while inside of the flowers. A mutant version of the plant with red flowers becomes more common with the passage of time. A particular variant of the beetle prefers the red flowers to the orange flowers. Over time, these two beetle variants diverge from each other to such an extent that interbreeding is no longer possible. What kind of speciation has occurred in this example, and what has driven it?

A) allopatric speciation; ecological isolation

B) sympatric speciation; habitat differentiation

C) allopatric speciation; behavioral isolation

D) sympatric speciation; sexual selection

E) sympatric speciation; polyploidy

A biologist spent many years researching the rate of evolutionary change in the finch populations of a group of islands. It was determined that the average beak size (both length and mass) of finches in a certain population increased dramatically during an intense drought between 1981 and 1987. During the drought, there was a reduction in the number of plants producing thin-walled seeds.

13. Which of the following statements might best explain the increase in average beak size in the finch population during the drought?

A) Finches with bigger beaks are better able to crack thick-walled seeds and produce more surviving offspring.

B) Finches with bigger beaks can attack and kill finches with smaller beaks.

C) Finches with bigger beaks possess more- powerful flight muscles and are able to find more food.

D) Finches that crack large seeds develop larger beaks over time.

14. If the half-life of carbon-14 is about 5,730 years, then a fossil that has one-sixteenth the normal proportion of carbon-14 to carbon-12 should be about how many years old?

A) 1,400

B) 2,800

C) 11,200

D) 16,800

E) 22,900

15. The oxygen revolution changed Earth's environment dramatically. Which of the following took advantage of the presence of free oxygen in the oceans and atmosphere?

A) the evolution of cellular respiration, which used oxygen to help harvest energy from organic molecules

B) the persistence of some animal groups in anaerobic habitats

C) the evolution of photosynthetic pigments that protected early algae from the corrosive effects of oxygen

D) the evolution of chloroplasts after early protists incorporated photosynthetic cyanobacteria

E) the evolution of multicellular eukaryotic colonies from communities of prokaryotes